

Digital Maturity of Schools - Explanation, Literature Review and Analysis

Melita Milić, Blaženka Divjak
Faculty of Organization and Informatics
University of Zagreb
Pavlinska 2, Varaždin, Croatia
{mzahtila, bdivjak}@foi.hr

Abstract. *In this paper we present a systematic literature review of studies related to digital maturity of schools. The focus is on the identification of the most significant papers from the field of digital maturity of schools, essential elements of digital maturity frameworks and their validation, as well as the connection with other sectors related to the school. The analysis shows that ICT infrastructure is an important but not sufficient element for digital transformation. Digital transformation is also influenced by digital competences of schools' employees, use of ICT in teaching and learning and administration, and the strategic approach to digital transformation.*

Keywords. digital maturity, digital maturity framework, schools, systematic literature review

1 Introduction

Digital maturity of schools is an important concept which shows the extent of schools' willingness for a digital transformation and/or the level of implementation of digitalization. Digital transformation is a systematic and planned change which schools must undergo in order to prepare their students for the use of digital technology in an efficient and safe manner.

The term "digital maturity" is often interchangeably used with "digital transformation" to describe what a company or an institution has already accomplished in terms of conducting transformational efforts and in what ways they are systematically preparing for adapting to an increasingly digital environment in order to remain competitive (Begicevic Redjep et al., 2021). Further, Chaniias & Hess (2016) defined digital maturity as "the status of a company's digital transformation" – it describes "what a company has already achieved with regard to transformation efforts". Therefore, digital maturity models „on the one hand aim at measuring the current level of a company's digitalization, on the other hand at providing a model path to digital maturity“ (Henderson et al., 2021). The development of digital competences is necessary to support people in strengthening themselves for life and

work in a digital environment during the time of the 4th industrial revolution.

Schools have an important role in transferring knowledge and developing digital competences. Therefore, the purposeful use of Information and Communications Technology (ICT) in schools must be systematically planned and implemented. The use of ICT in schools is not a matter of individuals' enthusiasm anymore, but rather of a systematic approach planned and implemented at a school level, in accordance with local and state policies (Zugec et al., 2018). A European Union (EU) survey showed that 44% of EU citizens and 47% of Croatian citizens between the ages of 16 and 74 do not have basic digital skills (DESI - Compare Countries Progress — Digital Scoreboard - Data & Indicators, n.d.), while retraining and acquiring new skills should be the key element of national recovery plans related to the COVID-19 pandemic. Educational authorities and teachers must put in additional effort to improve digital competences of teachers to be used in the regular educational process, as well as in extraordinary contexts and challenges such as those brought by the COVID-19 pandemic (Svetec & Divjak, 2021).

Systematic application of digital technologies in educational and administrative processes in schools represents the basis of digital maturity in schools. Due to the growing importance of technology, the concept of digital maturity of schools is becoming more significant within contemporary educational systems. Continuous monitoring of schools encourages the improvement of digital skills of the 21st century citizens in order to support them in the safe use of digital technology for improving social engagement (Fozo Attila & Racsco, 2020).

The concept of digital maturity has been mostly used in industry. There is a systematic literature review (SLR) of digital maturity models (DMM) for companies that evaluates existing DMMs with regard to their conformity to quality standards and theoretical foundation. (Thordsen et al., 2020)

Literature from the field of digital maturity of schools is scarce and points to inconsistencies, in defining the model of maturity, as well as in the terminology. Pata et al. (2021) noticed that many articles cover digital competences of teachers and/or

students rather than considering a holistic approach which would also include other domains.

The main purpose of this research emerges from the previous statement, and the goal of this review is to provide an in-depth and systematic overview of the literature that refers to models of digital maturity of schools.

Furthermore, for maturity models, it is necessary to check their validity. According to Thordsen et al. (2020), the validity of measurement is evaluated through the underlying assertions, building a complex net of arguments to back up the findings.

This paper presents a literature review and an analysis of identified models of digital maturity of schools. Based on the literature review, good practices and shortcomings in former studies are identified and recommendations for further research are offered.

This paper is structured as follows. The introductory part which explains the term of digital maturity in schools, the actuality and relevance of the topic, goals, and contributions of the paper. In the second section, the methodology of the research is introduced, and research questions are given, whilst in the third section the findings on digital maturity frameworks for schools are presented, including analysis of former research and recommendations for further research. The conclusion offers a summary of the paper.

2 Research questions and search methodology

At the beginning of this paper the most important research questions were highlighted, followed by the description of the research methodology. The goal of this paper was to implement an SLR and then to answer four research questions related to the analyzed papers:

RQ 1. Which are the most significant papers in the field of digital maturity of schools?

RQ 2. Is a digital maturity framework described in the paper?

RQ 3. Does the paper cover the validation of the framework?

RQ 4. Is the digital maturity of schools connected to other sectors, organizations, and public bodies?

The process of acquiring answers to the posed research questions was initiated with a systematic overview of the literature composed of published scientific papers which were searched for in relevant databases: Web of Science (WoS) and Scopus, accessed on the 1st of December 2021 and 27th of April 2022. Similar to Divjak et al. (2022), the process of acquiring the answers was conducted in three phases, as shown in Figure 1.

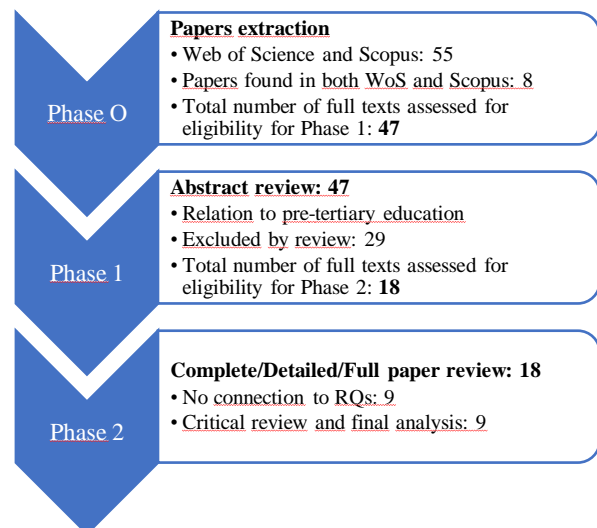


Figure 1. Phases of literature review

WoS and Scopus were searched based on the following keywords: “digital maturity“ AND school.

The searching structure and the number of chosen papers from individual sources is shown in Table 1.

A total of 55 research papers were found in both databases. Eight identical papers were identified in both databases, thus making 47 the total number of research papers extracted in Phase 0. In Phase 1, the papers' summaries were reviewed in order to identify and analyze research related to pre-tertiary education (schools).

Finally, we got 18 relevant papers shown in Table 1., sorted alphabetically. Aside from basic data about the paper, the table displays answers to the second, third and fourth research question.

Table 1. Review of RQs

Reference	RQ 2.	RQ 3.	RQ 4.
(Balaban et al., 2018)	yes	yes	yes
(Begicevic Redjep, n.d.)	yes	yes	yes
(Dejanovic & Jugo, 2019)	no	no	no
(Gaftandzhieva et al., 2022.)	yes	no	yes
(Ifenthaler & Egloffstein, 2020)	yes	yes	no
(Jeladze & Pata, 2018b)	no	no	yes
(Jeladze & Pata, 2018a)	yes	yes	no
(Jugo et al., 2017)	yes	no	yes
(Klacmer Calopa et al., 2018)	no	no	yes
(Kolic- Vehovec et al., 2015)	no	no	no
(Fozo Attila & Racsko, 2020)	no	no	yes

(Leonidova et al., 2020)	no	no	no
(Mekovec et al., 2019)	no	no	no
(Pata et al., 2021)	no	no	yes
(Sotiriou et al., 2016)	yes	no	yes
(Towndrow & Fareed, 2015)	no	no	no
(Vuk et al., 2020)	no	no	no
(Zugec et al., 2018)	yes	no	yes

3 Findings and discussion

Below we describe the results and certain limitations of our study.

Among the 18 chosen research papers, Croatia is the most represented country based on the number of published papers (nine), followed by United Kingdom (seven). Other countries are represented with a maximum number of three papers. Considering the research papers which were chosen due to their relevance for pre-tertiary education, Croatia once again stands out with nine published papers, which makes up a half of the chosen research papers. The explanation behind such a great number of Croatian papers is the E-Škole (e-Schools) project ('E-Škole', n.d.) during which broad research about the digital maturity of schools was conducted.

The full name of the entire program is "e-Schools: a comprehensive informatization of school operation processes and teaching processes aimed at the development of digitally mature schools for the 21st century". The program consisted of two phases. The first pilot phase of the project started in 2015 and lasted until 2018, and the second phase lasted from 2018 until 2022. The goal of the e-Schools program was to establish a system for digitally mature schools through piloting and evaluating the application of ICT in educational and administration processes in 10% of schools in Croatia. The general goal of the e-Schools program is to support the strengthening of primary and secondary education systems' capacity to prepare students for the labor market, further education and lifelong learning ('E-Škole', n.d.).

3.1 Quote analysis

In the analysis of the 18 research papers which were identified as relevant for pre-tertiary education, four papers stand out. First, Ifenthaler & Egloffstein (2020), with 10 citations in the Scopus database and five citations in the WoS database, is the highest cited. Moreover, there are three papers (Balaban et al., 2018; Sotiriou et al., 2016; Jeladze & Pata, 2018b) with nine citations each in the Scopus database, and fewer quotes in the WoS database.

The oldest research paper from the chosen set of papers related to pre-tertiary education is a paper published in 2015 (Kolic-Vehovec et al., 2015).

In order to gain insight into the interconnections of the selected papers, it was necessary to search for all the references listed in the 18 papers. The Gephi tool was used for the analysis. The citation analysis was conducted on the chosen papers, all 18 of them. Those 18 papers were cited by 47 unique papers, which makes 65 nodes in total. The analysis found 53 connections between them (edges in the graph). Visualization was created by using Force Atlas 2, which is appropriate for small and medium graphs and adapted for a qualitative interpretation of graphs. The option of non-overlapping was enabled in order to see the formed clusters more clearly.

By extracting the biggest nodes in the Gephi tool, the key research papers were recognized, which answers RQ1: Which are the most significant papers that cover the field of digital maturity of schools?

Figure 2 shows the visualization containing all the 18 research papers and three more important papers that appeared in the citation analysis.

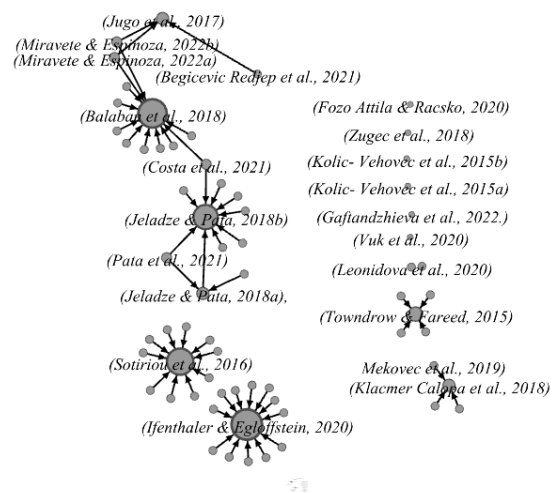


Figure 2. Correlation of quoted papers

The right side of Figure 2 shows papers with less citations. Besides Ifenthaler & Egloffstein (2020) and Sotiriou et al. (2016) on the left side, there is one larger group which is presented by Balaban et al. (2018) and one by Jeladze & Pata (2018b). Those two papers are cited by Costa et al. (2021), presenting the bridge between the two groups. Costa et al. (2021) and both papers from authors Miravete & Espinosa were not found neither in the WoS nor in the Scopus database during the search phase, and they should be included in further consideration. Balaban et al. (2018) is the earliest paper, with the highest number of citations, therefore it is the most significant in third group.

3.2 Digital maturity of schools

The coordination of all stakeholders and elements of the change is essential for the digital transformation of

the schools and project sustainability. In order to support meaningful and sustainable digital transformation, a unique and fully comprehensive concept of digital maturity of schools is needed. One such concept is described in Begicevic Redjep et al. (2018), but we will show other relevant concepts as well.

The analysis regarding the research questions is shown in Table 1. The place foreseen for the answer to RQ 2 is marked affirmatively even though the paper only includes some elements of the framework.

The summative overview of the answers to the research questions is shown in Table 2.

Table 2. Summative overview to the posed RQs

	RQ 2	RQ 3	RQ 4
Yes	8	4	10
No	10	14	8

Only eight studies refer to the digital maturity framework. From out of these eight research papers, only four had undergone framework validation. Most of the papers, ten of them, connect the digital maturity of schools with school investments and other sectors. The investment sponsors are the European Union (European Social Fund, European Regional Development Fund), and national authorities, such as education ministries. Other bodies and institutions, such as the Institute for Prospective Technological Studies, Joint Research Centre, provide support in the development of digital maturity models. There are also different initiatives in countries, such as strategies for digital education (e.g., Hungary, Croatia), which also support the development of digital maturity models. From the 18 analyzed papers, six do not provide elements which could offer positive answers to posed research questions RQ 2. - RQ 4., thus they are omitted from Figure 3.

The answers to all three research questions (RQ 2 – RQ 4) were affirmative only in two papers (Balaban et al., 2018; Begicevic Redjep et al., 2021) that discuss the Framework for Digital Maturity (FDMS) designed for the needs of Croatian schools within the e-Schools project.

The FDMS is described in four of the eight papers, and it influenced the model named DigBGSchool of digital maturity of schools in Bulgaria. Self-reflection in the Effective Learning by Fostering the Use of Innovative Educational Technologies (SELFIE) tool was taken as a basis for FDMS. SELFIE originated within EU's educational action as a free tool designed to help schools embed digital technologies into teaching, learning and assessment. (About SELFIE | European Education Area, n.d.).

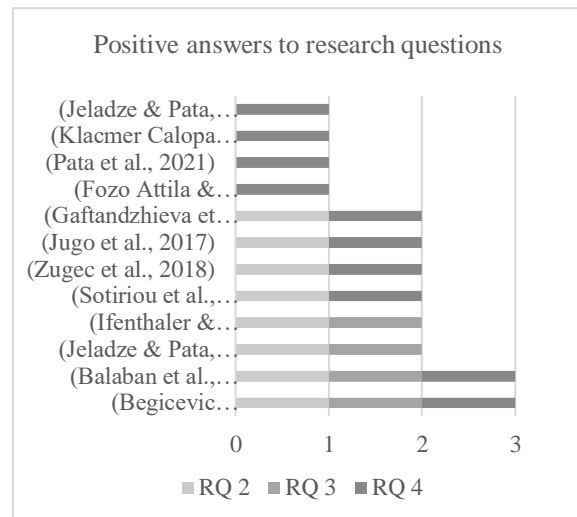


Figure 3. Display of research papers that positively answered the individual research questions

An Irish model, the Digital Schools of Distinction Program (DSoDP) (Coffey, n.d.), was developed before the FDMS, while the Maturity Model for Educational Organizations (MMEO) (Ifenthaler & Egloffstein, 2020) came to be after the FDMS. The MMEO was developed based on six models: Digital Maturity & Transformation Report, Digitalization Barometer, Maturity Index Industry 4.0, Digital Transformation Report, Business Index DIGITAL and Model of digital maturity (Ifenthaler & Egloffstein, 2020). All of the models are recent and the most recent one is the BigBGSchool, developed in 2021 for the needs of schools in Bulgaria (Gaftandzhieva et al., 2022).

In all the frameworks (models) the ICT infrastructure element is recognized as a cornerstone element without which achieving the digital maturity of schools is impossible. We noticed that all models have also the element of planning, managing and strategic leadership in some form, as well as the ICT culture element. Most differences can be found in relation to the ICT learning and teaching domain. This domain is not explicitly mentioned in the MMEO. Furthermore, the domain related to developing digital competences is not emphasized as a separate domain in the DSoDP.

Table 3. can contribute to answering the third research question related to the validation of the framework, if any.

Table 3. Validation of the framework

Reference	RQ 3.
(Balaban et al., 2018)	yes <i>p</i> -value Spearman correlation coefficient
(Begicevic Redjep, n.d.)	yes Fornell–Larcker
(Ifenthaler & Egloffstein, 2020)	yes <i>p</i> -value

	Spearman correlation coefficient
(Jeladze & Pata, 2018a)	yes regression analysis

Four research papers which contain validation of the framework are marked with the medium color in Figure 3. Two of the papers refer to regression analysis (Sotiriou et al., 2016; Jeladze & Pata, 2018a). Data collected through the external evaluation of the e-Schools pilot project in Croatia were used in corresponding papers (Balaban et al., 2018; Begicevic Redjep et al., 2021) for validation purposes. The paper by Balaban et al. (2018) describes 38 elements and validation by the Spearman’s coefficient. At the end of the pilot project, Begicevic Redjep et al. (2021) measured the validity and reliability with SmartPLS and Cronbach alpha, and 24 indicators were retained as relevant. Ifenthaler & Egloffstein (2020) also used Spearman’s coefficient in the validation process. To conclude, only four papers (Balaban et al., 2018; Begicevic Redjep, 2021; Ifenthaler & Egloffstein, 2020; Jeladze & Pata, 2018a) conducted the maturity framework validation.

As many as ten research papers connect digital maturity frameworks with other sectors, institutions or bodies that are related to schools, as shown in Table 4.

Table 4. Connection with other sectors

Reference	RQ 4.
(Balaban et al., 2018)	yes investing in education - European Social Fund (ESF); European Regional Development Fund (ERDF)
(Begicevic Redjep, n.d.)	yes investing in education - ESF; ERDF
(Gaftandzhieva et al., 2022.)	yes investing in education - Ministry of Science and Education of Bulgaria
(Jeladze & Pata, 2018b)	yes development of society as a whole
(Jugo et al., 2017)	yes Investing in Education - EU Commission, Institute for Prospective Technological Studies, Joint Research Centre
(Klacmer Calopa et al., 2018)	yes Investing in Education - ESF; ERDF
(Fozo Attila & Racsko, 2020)	yes Investing in Education - Hungary's Strategy for Digital Education

(Pata et al., 2021)	yes Investing in Education - Estonian Ministry of Education and Research
(Sotiriou et al., 2016)	yes Investing in Education - Open Discovery Space
(Zugec et al., 2018)	yes Investing in Education - ESF; ERDF

In the paper by Jeladze & Pata (2018b) it is described that the digital maturity of schools affects the development of society in its entirety, while other papers (Klacmer Calopa et al., 2018; Pata et al., 2021; Fozo Attila & Racsko, 2020; Gaftandzhieva et al., 2022; Jugo et al., 2017; Zugec et al., 2018; Sotiriou et al., 2016; Balaban et al., 2018; Begicevic Redjep et al., 2021) link it to investment in education on a national level, as well as EU level, using e.g. the European Social Fund and the European Regional Development Fund, which shows that the importance of investing in skills of digital education has been recognized. Ifenthaler & Egloffstein (2020) and Jeladze & Pata (2018) do not showcase any clear connections to other sectors.

When taking in consideration the entirety of the analyzed research on the digital maturity of schools, there is inconsistency in defining a maturity model and the use of terminology. Pata et al. (2021) noticed that there are many articles regarding digital competences of teachers and/or students and just a few taking a broader perspective on digital transformation of schools. In comparison with Thordsen et al. (2020), it can be determined that a series of articles about the FDMS formed comprehensive research in this context, including definitions and measurement procedures, the theoretical framework and empirical aspects.

In order to take an even broader perspective it would be necessary to link digital maturity of schools to other elements that are not part of the existing frameworks’ scope or impact evaluation, for example monitoring student success in the next stage of education, as well as their careers after finishing school. The COVID-19 pandemic and isolation period discovered the fragility of digitally immature organizations (Fletcher & Griffiths, 2020; Svetec & Divjak, 2021) during external threats. Were digitally mature schools better at managing (themselves) during the pandemic by using all available resources (digital books, open content, ...) and/or did this content contribute to the digital maturity of schools? This research question is still awaiting an answer. The limitations of this research are related to the selection of keywords, databases and the language in which the analyzed papers were written.

4 Conclusion

The goal of this paper was present a systematic review of literature that refers to identification of digital maturity frameworks for schools, elements of the frameworks, their validation, and connection to other sectors. The fact that only 18 research papers from the field of digital maturity of schools were identified shows that literature in this territory is scarce. Thanks to the e-Schools project, Croatia is the most represented country in literature that covers the field of digital maturity of schools.

Only four of 18 papers reported on some sort of framework validation.

The element of ICT infrastructure was recognized in all frameworks, while differences can be found in the ICT learning and teaching domain and the developing digital competences domain, which are not explicitly recognized all the frameworks as separate domains.

This SLR demonstrates the need for a holistic and comprehensive approach to defining and measuring the digital maturity of schools. Furthermore, in order to analyze the digital maturity of schools as part of broader educational and societal ecosystem, it would be necessary to link the digital maturity of schools to other elements, for example monitoring student success in the next stage of education, as well as their careers after finishing school.

Finally, the unprecedented situation with the COVID-19 pandemic revealed the fragility of less digitally mature organizations to act efficiently in times of crisis. Therefore, it is of utmost importance to further develop the concept and instruments related to the digital maturity of schools.

References

- About *SELFIE* | European Education Area. (n.d.). Retrieved 17 May 2022, from <https://education.ec.europa.eu/node/1544>
- Balaban, I., Begicevic Redjep, N., & Klacmer Calopa, M. (2018). The Analysis of Digital Maturity of Schools in Croatia. *International Journal of Emerging Technologies in Learning (IJET)*, 13(06), 4. <https://doi.org/10.3991/ijet.v13i06.7844>
- Begicevic Redjep, N. (n.d.). *Assessing digital maturity of schools: Framework and instrument*.
- Begicevic Redjep, N., Balaban, I., & Zugec, B. (2021). Assessing digital maturity of schools: Framework and instrument. *Technology, Pedagogy and Education*, 30(5), 643–658. <https://doi.org/10.1080/1475939X.2021.1944291>
- Chanias, S., & Hess, T. (2016). How digital are we? Maturity models for the assessment of a company's status in the digital transformation. *Rep./Institut Für Wirtschaftsinformatik Und Neue Medien*, 2, 1–14.
- Croatia—National Development Strategy 2030 | Digital Skills and Jobs Platform. (n.d.). Retrieved 16 May 2022, from <https://digital-skills-jobs.europa.eu/en/actions/national-initiatives/national-strategies/croatia-national-development-strategy-2030>
- Dejanovic, L., & Jugo, G. (2019). Managing Integration Of Digital Technologies In Schools—Principal Role And Competences. *12th International Conference Of Education, Research And Innovation (Iceri2019)*.
- DESI - Compare countries progress—Digital Scoreboard—Data & Indicators. (n.d.). Retrieved 16 May 2022, from [https://digital-agenda-data.eu/charts/desi-see-the-evolution-of-two-indicators-and-compare-countries#chart={%22indicator%22:%22desi_hc_bds%22,%22breakdown%22:%22ind_total%22,%22unit-measure%22:%22pc_ind%22,%22ref-area%22:\[%22HR%22,%22EU%22\]}](https://digital-agenda-data.eu/charts/desi-see-the-evolution-of-two-indicators-and-compare-countries#chart={%22indicator%22:%22desi_hc_bds%22,%22breakdown%22:%22ind_total%22,%22unit-measure%22:%22pc_ind%22,%22ref-area%22:[%22HR%22,%22EU%22]})
- Fletcher, G., & Griffiths, M. (2020). Digital transformation during a lockdown. *International Journal of Information Management*, 55, 102185. <https://doi.org/10.1016/j.ijinfomgt.2020.102185>
- Fozo Attila, L., & Racsco, R. (2020). The possibilities of assessment of the schools' digital maturity. *Civil Szemle*, 17(3), 93–+.
- Gaftandzhieva, S., Doneva, R., & Docheva, M. (2022). *Digital Maturity Level of Bulgarian Primary and Secondary Schools*. 14.
- Henderson, D., Munday, M., & Roberts, A. (2021). How to Measure Digitalization? A Critical Evaluation of Digital Maturity Models. *National Institute Economic Review*, 255, 42–55. <https://doi.org/10.1017/nie.2020.48>
- Ifenthaler, D., & Egloffstein, M. (2020). Development and Implementation of a Maturity Model of Digital Transformation. *TechTrends*, 64(2), 302–309. <http://link.springer.com/10.1007/s11528-019-00457-4>
- Jeladze, E., & Pata, K. (2018a). *The model of self-organization in digitally enhanced schools*. 17.
- Jeladze, E., & Pata, K. (2018b). Smart, Digitally Enhanced Learning Ecosystems: Bottlenecks to Sustainability in Georgia. *Sustainability*, 10(8), 2672. <https://doi.org/10.3390/su10082672>
- Jugo, G., Balaban, I., Pezelj, M., & Begicevic Redjep, N. (2017). Development of a Model to Assess the Digitally Mature Schools in Croatia. In A. Tatnall & M. Webb (Eds.), *Tomorrow's Learning: Involving Everyone. Learning with and about Technologies and Computing* (Vol. 515, pp. 169–

- 178). Springer International Publishing.
https://doi.org/10.1007/978-3-319-74310-3_19
- Klacmer Calopa, M., Tomicic Pupek, K., & Begicevic Redep, N. (2018). *Methodology For Strategic Planning Of Ict Integration In Educational Institutions: Evidence From Primary And Secondary Schools In Croatia*. 5478–5484.
<https://doi.org/10.21125/edulearn.2018.1322>
- Kolic- Vehovec, S., Miletic, I., K. Maglica, B., & M. Dorcic, T. (2015). Information And Communication Technologies (Ict) In Education: A Case Study Of Two Elementary Schools. *7th International Conference on Education and New Learning Technologies*, 4949–4957.
- Leonidova, G., Valiakhmetov, R., Baimurzina, G., & Babich, L. (2020). Problems and Prospects of Distance Learning in the Estimates Provided by Teachers and Schoolchildren's Parents. *Economic and Social Changes: Facts, Trends, Forecast / Экономические и Социальные Перемены: Факты, Тенденции, Прогноз*, 13(4 (70)), 202–2019. <https://doi.org/10.15838/esc.2020.4.70.12>
- Mekovec, R., Žajdela Hrustek, N., Kirinić, V., Hutinski, Ž., & Klačmer Čalopa, M. (2019). *Defining Competence Description Elements For School Principals' Digital Competence Framework: Croatian Example*. 5074–5081.
[https://doi.org/Managing integration of digital technologies in schools - principal role and competences](https://doi.org/Managing%20integration%20of%20digital%20technologies%20in%20schools%20-%20principal%20role%20and%20competences)
- Pata, K., Tammets, K., Väljataga, T., Kori, K., Laanpere, M., & Rõbtsenkov, R. (2021). The Patterns of School Improvement in Digitally Innovative Schools. *Technology, Knowledge and Learning*. <https://doi.org/10.1007/s10758-021-09514-5>
- Sotiriou, S., Riviou, K., Cherouvis, S., Chelioti, E., & Bogner, F. X. (2016). Introducing Large-Scale Innovation in Schools. *Journal of Science Education and Technology*, 25(4), 541–549.
<https://doi.org/10.1007/s10956-016-9611-y>
- Svetec, B., & Divjak, B. (2021). Emergency Responses to the COVID-19 Crisis in Education: A Shift from Chaos to Complexity. *EDEN Conference Proceedings, 1*, 513–523.
<https://doi.org/10.38069/edenconf-2021-ac0051>
- Thordsen, T., Murawski, M., & Bick, M. (2020). How to Measure Digitalization? A Critical Evaluation of Digital Maturity Models. In M. Hattings, M. Matthee, H. Smuts, I. Pappas, Y. K. Dwivedi, & M. Mäntymäki (Eds.), *Responsible Design, Implementation and Use of Information and Communication Technology* (Vol. 12066, pp. 358–369). Springer International Publishing.
https://doi.org/10.1007/978-3-030-44999-5_30
- Towndrow, P., & Fareed, W. (2015). Growing in digital maturity: Students and their computers in an academic laptop programme in Singapore. *Asia Pacific Journal of Education*, 35(4), 438–452.
[https://doi.org/Introducing Large-Scale Innovation in Schools](https://doi.org/Introducing%20Large-Scale%20Innovation%20in%20Schools)
- Vuk, B., Mornar, V., & Boticki, I. (2020). ICT in School Education in Croatia. In C.-K. Looi, H. Zhang, Y. Gao, & L. Wu (Eds.), *ICT in Education and Implications for the Belt and Road Initiative* (pp. 37–52). Springer Singapore.
https://doi.org/10.1007/978-981-15-6157-3_3
- Zugec, B., Balaban, I., & Divjak, B. (2018). *The Development Of An Instrument For Assessing Digital Maturity Of Schools*. 8557–8565.
<https://doi.org/10.21125/edulearn.2018.1990>